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## Cellulose Based Surgical Threads from Oil Palm Empty Fruit Bunches in Wound Healing on Male Wistar Rats

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### Abstract

The aim of this study was to elaborate a histological model of incisional skin wound healing against cellulose nanofiber based surgical threads from oil palm empty bunches on male wistar rats. Skin incisions were performed on rat femoral muscle, immediately sutured by cellulose nanofiber based surgical threads. Hematological analysis was performed on white blood cell. Histological sections of thigh skin tissue were stained by hematoxylin and eosin evaluated after surgery. White blood cell and wound healing process in tissues after surgery was compared to controls.

**Keywords:** cellulose nanofiber, surgical threads, wound healing.

Palm oil is the largest commodity produced by Indonesia as the world's largest palm oil producer. Leading production of biomass in the form of oil palm empty fruit bunches (OPEFB) of 23% (Mandiri, 2012). Fibers of OPEFB contain cellulose 44.4%, hemicellulose 30.9% and lignin 14.2% which can be used as value added products (Sun *et al.* 1999). Utilization of nanocellulose from OPEFB as a raw material for making surgical threads is evaluated in this study.

### Materials and Methods

A total of 35 healthy male wistar rats aged 8-10 weeks weighing 150-200 g were distributed into seven groups of 5 animals each. No surgery was performed in control group. Surgical thread groups were silk (Group 1), nanocellulose (NC, Group 2); polyvinyl alcohol (PVA, Group 3); mixed of polyvinyl alcohol and bacterial cellulose (PVA-BC, Group 4); mixed of polyvinyl alcohol

and nanocellulose (PVA-NC ~ 80 : 20, Group 5); mixed of polyvinyl alcohol and nanocellulose (PVA-NC ~ 70 : 30, Group 6), respectively.

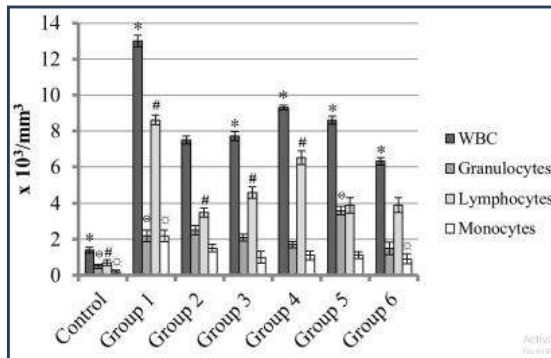
On a day of surgery, the animals were anesthetized with diethyl ether. The 2.5 cm incisions were made under aseptic conditions on the right side femoral muscle and immediately sutured by 3 simple sutures. On day 5 post-operative, the peripheral blood was taken and the rats were sacrificed by diethyl ether inhalation. The hematological analysis was performed on white blood cell. The skin wounds were removed from the femoral (thigh area) skin. The tissue specimens were processed routinely for histological study and stained with hematoxylin-eosin for monitoring wound healing using tissue reaction parameters on different suture materials. The observation of polymorpho nuclear leukocytes, macrophages, fibroblast cells were performed by calculating per five square areas as per (Gal *et al.*, 2008), while the qualitative observation was carried out on formation of epithelial bridge and connective tissue, collagen fibre and granulomatous tissues (Sultana, *et al.* 2009). Data of white blood cell count, PMNL, tissue macrophages and fibroblasts were obtained in duplicate and mean  $\pm$  SD was calculated. A P-value  $< 0.05$  was considered statistically significant.

### Results and Discussion

During the post-surgery period, the animals remained healthy. On a day 5 post-surgery presence of coagulum, i.e. fibrous clot, was observed in all animals from the experimental groups.

The control rats, had normal white blood cell count (Faas *et al.*, 2003). The white blood cells count in experimental group 1 was the highest compared to other rats groups. The

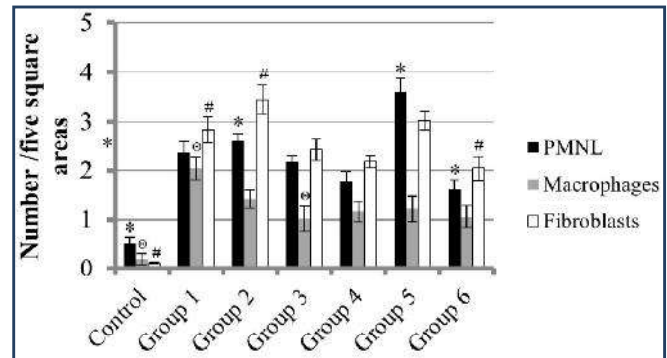
<sup>1</sup>Corresponding author : Email : muhyunus\_99@yahoo.com



**Fig 1.** The hematological analysis of blood of each rat groups in surgical threads of 5 days after surgery and suturing. \*, #, those symbols mean representative significantly different ( $p < 0.05$ ).

WBC, granulocytes, lymphocytes, and monocytes were recorded in the descending order of 1, 4, 5, 3, 2, and group 6 respectively (Fig 1).

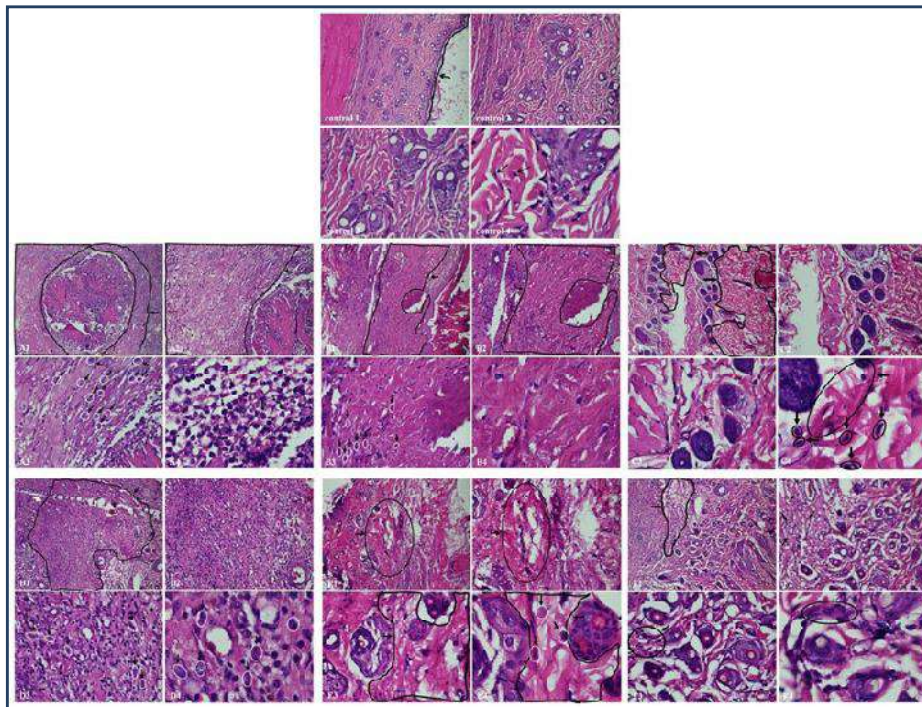
Histological changes during wound healing in rats sutured different with surgical threads showed increase in the polymorphonuclear leukocytes, macrophages and fibroblasts in all experimental groups compared with control group (Fig. 2).



**Fig 2.** The histological changes through tissue reaction parameters during rat skin wound healing in surgical threads of 5 days after surgery and suturing. \*, #, ( $p < 0.05$ ).

In general wound healing in rat group 1 to 6 showed increasing fibroblast cells and development of more extracellular matrix, fibrous tissue, collagen. The presence of macrophages in the wound, were observed in all the experimental groups indicating the healing process in the incised skin area (Fig. 3)

In general, some surgical threads tested in rat surgery did not produce ugly irritation in the suture area by scratching or biting and



**Fig 3.** The increase of inflammatory and granulation cells, collagen tissue on the suture wound area on rat skin tissue in the wound healing process using surgical threads [A-F(1-4); control 1-4].

they have resumed their normal appetite soon, observations on sutures show varying levels of recovery and tissue response. The wound healing process of rat skin was histomorphologically and chronologically described during the first five days. Evaluation histological differences at different time intervals of i.e. the first, third, fifth, seventh and tenth day by Connolly *et al.* (1997) observed an influence of various factors on the wound healing. The present findings concurs the histomorphological based studies of rat skin by (Marcelo *et al.* 2003).

Vidinský *et al.* (2016) reported that the regeneration of injured epidermis was completed in five days after surgery and the inflammatory phase during the first three days of healing was fast between day one and day two concurring our finding. The proliferative phase started on the first day and peaked during day five and day six, which is slow in humans, where in this phase starts on the seventh day of wound healing (Kumar *et al.* 2003). The initiation of the maturation and remodeling phase of the healing process was observed after six days of wound healing (Kumar *et al. loc cit*). During the repair and remodeling phase of muscle healing. They are concurrent processes but at the same time supportive but also competitive with each other (Järvinen *et al.* 2005).

In conclusion, the use of surgical threads based on cellulose nanofiber from OPEFB could be applied to traumatic wounds with variations in the response of white blood cells and tissue reactions for each type of surgical thread in the wound healing process without significant differences in the duration of healing. Therefore, results of this work can serve as an experimental model for further research using external factors by which the wound healing can be favourably influenced.

## Summary

Cellulose nanofiber based surgical threads from (OPEFB) were used suture materials in rat model. Six cellulose nanofiber based surgical threads and control group were evaluated for the wound healing response on white blood cell

and granulation tissue. Proliferation and migration of white blood cell and granulation tissue components in wound healing process increased in sutures area compared to the control.

## Acknowledgement

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Proceedings of the meetings of Managing Committee of Indian Veterinary Association and Editorial Board of the Indian Veterinary Journal held in Chennai on 09.06.2019 at Hotel Raj Palace, T. Nagar, Chennai.

The meeting was started with the Veterinarian Oath as invocation. The President presided over the meeting. Dr Abdul Rehman, Executive Secretary of CWVA was the special invitee for the meeting. Dr Srinivasan of Indian Immunological Ltd presented a brief account on the need of Vaccination for Brucellosis and its recent developments. The President gave a brief details about the recently inducted 3 Central Ministers for Animal Husbandry, Dairy and Fisheries – One Cabinet rank and two state ministers from our Veterinary fraternity. The following agenda were discussed and decided.

**1. Marketing and Increasing IVJ subscription in all states:**

It was explained that for the past many years Govt. Of Tamil Nadu is subscribing IVJ for all the working vets and during 2018, the subscription was increased to more than 3000 copies every month. All the Zonal Secretaries and Vice Presidents are requested to promote IVJ subscription through the concerned A.H. Directors and Vice-Chancellors of Veterinary Universities. After a long discussion, the following are approved and resolved.

- ◆ The existing regular print subscription of Rs.800/- per year is to be promoted to other states.
- ◆ An Annual E-version subscription of Rs.100/- for all IVA members.
- ◆ This Annual E-subscription can be tagged to all Life Members at Rs.5100/-.
- ◆ The regular Annual E-subscription of IVJ for Non-members of IVA is Rs.200/-.

**2. IVJ indexing and Listing:**

It was explained with detailed about the third party indexing service and related listing service and their problems. The new IVJ Online Portal customised to IVJ will soon run the own Indexing Service of IVJ.

**3. Affiliation of State Associations to IVA :**

Out of the twenty states given the written consent of affiliation, only the three states namely the Arunachal Pradesh, West Bengal and Telengana submitted the complete details of the affiliation format given. The other affiliated states were also advised to give the details. The Managing Committee Members were requested to initiate the other states for affiliation with full details. All are advised to follow the Constitutional By Law for rates of affiliation fees.

**4. Revival of Veterinary Council of India for Professional benefits:**

The President, Dr Kadian informed the present status of VCI and decided to make use of the Veterinary Minister recently inducted in Central Cabinet to act immediately.

**5. Holding of Regional and National Conferences:**

It was unanimously decided a Regional Conference at Guwahati on 28.6.2019 and an International Conference at New Delhi during the last week of July or First week of August, 2019. There was also a discussion to use the Interest of Endowment Deposits of IVJ for the New Delhi conference. The IVJ Editorial Committee expressed that the modalities of use of Interest of Endowment Deposits will be decided only after the procedural advise of the Auditor, IVJ.

At about 4 pm, the meeting of interaction of senior vets of Tamil Nadu with the Managing Committee members of IVA was held at IVJ, Rao Sahib Dr T. Vinayaga Mudaliar meeting hall. There was a huge gathering of about 62 senior vets including Dr C. Balachander, VC of TANUVAS, Retired Directors of Animal Husbandry, Tamil Nadu, Dr S.P. Anbumani, Dr J.V. Krishnamurthy, Dr N. Chandramouli, Retired Addl. Directors – Dr P. Janarthanan, Dr K.S. Sundarajan and a colourfull combination of Retired RJD, JDs, DDs and Retired Professors and Associate Professors of TANUVAS. All the senior vets of Tamil Nadu appreciated all the recent excellent steps taken by senior vets of Tamil Nadu to revive the Indian Veterinary Association which was so solidly dormant for more than 18 years. The President of IVA, Dr C. Kadian explained the whole developments of the revived IVA from the full support and experienced advises of all senior vets of Tamil Nadu. The meeting was completed with an high tea and vote of thanks. On 10.6.2019 the President Dr C. Kadian, with the Secretary General Dr R.S. Patel, IVJ Editorial Board member Dr Panwar along with Tamil Nadu members of IVA in a good gathering met the Hon'ble Minister for Animal Husbandry, Dairying and Fisheries of Tamil Nadu, Principal Secretary, Animal Husbandry, Dairying and Fisheries of Tamil Nadu and the Director of Animal Husbandry as a curtsey call with prior appointment. During the meeting the President of IVA, Dr Kadian represented the pending implementation of NPA and DACP for Tamilnadu vets.

-- THE IVJ EDITORIAL COMMITTEE

## REVISED GUIDELINES TO AUTHORS

1. **THE INDIAN VETERINARY JOURNAL** (Official organ of the Indian Veterinary Association) publishes papers of original work as full papers, clinical articles and short communications on Veterinary, Animal Husbandry and Fishery Sciences. It also serves as a medium of news regarding the veterinary profession and deals with issues of professional importance from time to time through its editorial columns.
2. **Manuscripts are accepted for publication on the clear understanding that :**
  - a) They have neither been published nor been sent for publication elsewhere. All the authors should sign a certificate to this effect in respect of each manuscript sent for publication. Names, qualifications, full addresses and Email ID of all authors must be provided while submitting the manuscripts. Details of the corresponding author with contact phone and the address of the place with PIN code where the work has been carried out must be clearly mentioned.
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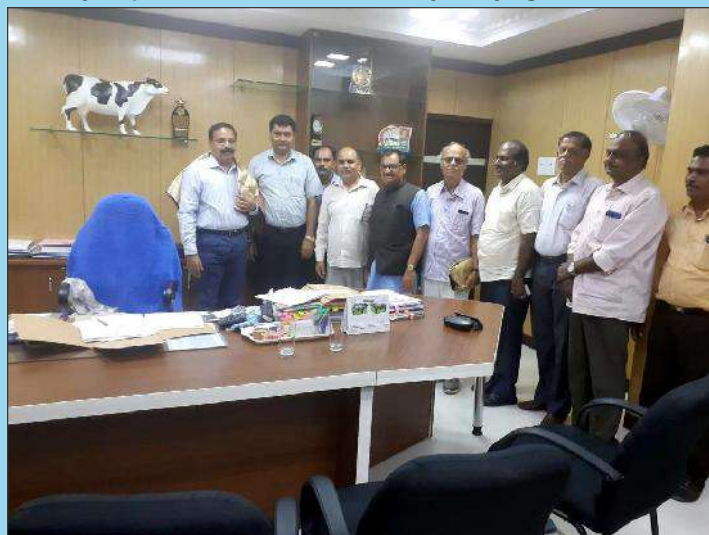
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**IVA Office Bearers meeting with  
Hon'ble Minister for Animal Husbandry, Dairying and Fisheries of Tamil Nadu.**



**IVA Office Bearers meeting with  
Principal Secretary, Department of Animal Husbandry, Dairying and Fisheries of Tamil Nadu.**



**IVA Office Bearers meeting with  
Director, Department of Animal Husbandry, Dairying and Fisheries of Tamil Nadu.**